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An Account of the Effect of Mercurial Vapours on the Crew of His Majesty's Ship Triumph, in the Year 1810. *By* William Burnett, *M.D. one of the Medical Commissioners of the Navy, formerly Physician and Inspector of Hospitals to the Mediterranean Fleet. Communicated by* Matthew Baillie, *M.D. F.R.S.* Read June 19, 1823. [*Phil. Trans.* 1823, *p.* 402.]

The Triumph arrived at Cadiz in 1810, and in the following March a Spanish vessel, laden with quicksilver, was wrecked under the batteries, then in possession of the French. The Triumph's boats were sent to her assistance, and about 130 tons of the quicksilver carried on board. The metal was secured in bladders packed in barrels, but the bladders having been wetted grew rotten, and the metal escaped in large quantities, got mixed with the provisions, and very soon affected the crew with ptyalism, ulcerated throats, &c. The different animals on board were also affected. From the extent of the mischief it was evident that the air of the confined part of the vessel contained mercurial vapour, and accordingly those who slept and messed in the orlop and lower decks were more severely affected than those chiefly confined to the upper deck; while the men who lived and slept chiefly under the forecastle, escaped with a slight affection of the gums.

On the Astronomical Refractions. By J. Ivory, *A.M. F.R.S.* Read June 19, 1823. [*Phil. Trans.* 1823, *p.* 409.]

The ancients, Mr. Ivory observes, were acquainted with the existence of atmospherical refraction; but the first that ascertained its magnitude with tolerable accuracy, and employed it in his calculations, was Tycho Brahé. Cassini attempted to compute the refraction upon optical principles, and upon the hypothesis of an uniform medium of uniform density,—a supposition which, though very simple, is sufficiently correct to a considerable extent. The next step was to imagine an atmosphere of a density uniformly decreasing as the height increases. Kramp was still more accurate in attending to the true effects of pressure and change of temperature; his methods have been improved and extended with great sagacity by Laplace, and the tables founded on his computations are perhaps the best in existence with respect to the value of the mean refractions.

An uniform atmosphere must be supposed to be five miles in height; an atmosphere uniformly decreasing in density ten. Kramp and Laplace consider it as infinite. The former limits would make the horizontal refraction less than the truth; the latter supposition much greater. Mr. Ivory is inclined to suppose some considerably extended, though finite height, which shall give the true refraction at the horizon, and which will probably be also correct for all other cases; and he thinks it not superfluous to inquire, whether such an atmosphere would afford results sensibly different from those of an atmosphere of infinite extent. The phenomena of twilight and of

meteors indicate, he observes, a height of forty or fifty miles, at which the atmosphere is dense enough to reflect a sensible quantity of light. At the height of about 25,000 miles the centrifugal force would become equal to the gravitation of the air, and the equilibrium would be no longer possible.

But the great reason that prevents our supposing an atmosphere infinitely extended, is the coldness of the upper regions. Mr. Ivory considers the elastic force as disappearing from the effect of cold upon the temperature, is 266 centigrade degrees below the freezing point; and he observes, that if the decrease uniformly amounted to a degree in 95 (English) fathoms, as it appeared to do in Gay Lussac's aerostatic observation, the whole height ought not to exceed 29 miles; consequently he thinks that the thermometer must fall at a slower rate in the higher than in the lower parts of the atmosphere.

Mr. Ivory proceeds to investigate the motion of light according to the laws of central forces, and to the experiments of Hauksbee and others on the refractive density of the air. He first shows that the formula employed by the French astronomers, as far as 74° from the zenith, is deducible from any imaginable law respecting the constitution of the atmosphere; and he gives, for example, the mode of obtaining it from that of Cassini.

He next considers the case of an equable variation of temperature in ascending, which he thinks is rendered probable, as the law of nature, by observations of Gay Lussac and others; and he inquires into the general methods of integrating the expressions of the refraction in such cases, according to the methods already employed by Kramp and Laplace. He examines, on various suppositions respecting the height of the atmosphere as connected with various laws expressing the progressive temperatures, beginning always from that which is observable at the earth's surface the amount of the horizontal refraction, which he finds not so materially affected by these suppositions as to enable us to decide with certainty, from observation, which of them ought to be preferred.

Upon these foundations the author investigates the actual magnitude of the refraction under different circumstances, by means of several infinite series, of which he computes the values; and he compares his results with those which have been observed by astronomers. The ingenious hypothesis of Laplace, he remarks, gives us a height of $59\frac{1}{2}$ fathoms for a depression of a centigrade degree, or 197 feet for 1° of Fahrenheit, which, he says, is little more than two thirds of the height actually corresponding to this depression; and the French table, he says, was computed for the foregoing point, and then altered proportionally throughout its extent for a difference of 10 centigrade degrees. As far as 86° from the zenith, Mr. Ivory's computations agree very accurately with those of Bessel; and further, this celebrated astronomer does not recommend the adoption of his table. The comparison of the new table with the observations of the French Astronomers, and of Dr. Brinkley, appears to be highly favourable to the accuracy of Mr. Ivory's results.